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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
09/957,395	09/19/2001	Anisul Khan	AM5782	4481

7590

08/26/2005

Patent Counsel
APPLIED MATERIALS, INC.
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EXAMINER

CULBERT, ROBERTS P

ART UNIT	PAPER NUMBER
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1763

DATE MAILED: 08/26/2005

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary

Application No.

09/957,395

Applicant(s)

KHAN ET AL.

Examiner

Roberts Culbert

Art Unit

1763

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 22 July 2005.
- 2a) ☒ This action is **FINAL**. 2b) ☐ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 26-49 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 26-49 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on _____ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☐ None of:
- ☐ Certified copies of the priority documents have been received.
 - ☐ Certified copies of the priority documents have been received in Application No. _____.
 - ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- | | |
|---|---|
| 1) <input type="checkbox"/> Notice of References Cited (PTO-892) | 4) <input type="checkbox"/> Interview Summary (PTO-413) |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948) | Paper No(s)/Mail Date. _____ |
| 3) <input type="checkbox"/> Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08) | 5) <input type="checkbox"/> Notice of Informal Patent Application (PTO-152) |
| Paper No(s)/Mail Date _____ | 6) <input type="checkbox"/> Other: _____ |

Art Unit: 1763

DETAILED ACTION

Continued Examination Under 37 CFR 1.114

A request for continued examination under 37 CFR 1.114, including the fee set forth in 37 CFR 1.17(e), was filed in this application after final rejection. Since this application is eligible for continued examination under 37 CFR 1.114, and the fee set forth in 37 CFR 1.17(e) has been timely paid, the finality of the previous Office action has been withdrawn pursuant to 37 CFR 1.114. Applicant's submission filed on 7/22/05 has been entered.

Response to Arguments

Applicant's arguments filed 7/22/05 have been fully considered but they are not persuasive.

Applicant has argued the previously cited references either alone or in combination fail to teach or suggest a method of making an optical waveguide including the steps of forming an opening through the upper surface of a semiconductor layer, depositing a bottom cladding layer on the upper surface of the semiconductor layer and conformally within the opening, depositing a core material to fill the opening, and removing excess core material without removing the bottom cladding layer.

However, the previously cited references teach all of the claim limitations as recited by applicant. Rejections based on the previously cited references are presented below.

Claim Rejections - 35 USC § 102

The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

Claims 26-28, 31 and 33 are rejected under 35 U.S.C. 102(b) as being anticipated by JP 05224055 A (referred to afterwards as the '055 patent)

Art Unit: 1763

Regarding claim 26, and referring to Figures 1-3, the '005 patent teaches a method of making an optical waveguide comprising: providing a substrate comprising a semiconductor layer (110) having an upper surface, forming an opening (190) through the upper surface of a semiconductor layer (110), depositing a bottom cladding layer (320) on the upper surface of the semiconductor layer and conformally within the opening, depositing a core material (330) to fill the opening, and removing excess core material without removing the bottom cladding layer, (See Figure 3(g)) and depositing a top cladding layer (160) over the core material.

Regarding Claims 27 and 28, the '055 patent teaches a silicon substrate (See Paragraph 11 of the attached translation)

Regarding Claims 31 and 33, the '055 patent teaches that the bottom cladding layer (320) and upper cladding layer (160) comprise silicon oxide.

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

This application currently names joint inventors. In considering patentability of the claims under 35 U.S.C. 103(a), the examiner presumes that the subject matter of the various claims was commonly owned at the time any inventions covered therein were made absent any evidence to the contrary. Applicant is advised of the obligation under 37 CFR 1.56 to point out the inventor and invention dates of each claim that was not commonly owned at the time a later invention was made in order for the examiner to consider the applicability of 35 U.S.C. 103(c) and potential 35 U.S.C. 102(e), (f) or (g) prior art under 35 U.S.C. 103(a).

Art Unit: 1763

Claim 29 is rejected under 35 U.S.C. 103(a) as being unpatentable over Japanese Patent JP 05224055 A in view of U.S. Patent 6,553,170 to Zhong.

As applied above, the '005 Patent discloses the method of the invention substantially as claimed, but does not teach that the cladding layers have a different refractive index.

However, it is well known in the art of wave-guide fabrication to form top, bottom and core layers of a wave-guide each having a different refractive index. Commonly the core layer must have a higher refractive index than the cladding layers as this aids in signal transmission. Also the top and bottom cladding layers are typically close to the same index of refraction, however, they do not have to be exactly the same as shown by Zhong. Zhong teaches that it is old in the art to form a wave-guide in which the bottom cladding is different from the upper cladding. See Background of the Invention (Col. 2, Lines 1-3). Note that the top clad is made from BPSG and the bottom clad is SiO₂ silica. *Note that these different materials inherently have a different refractive index.* Zhong further teaches a method of forming a wave-guide having top and bottom cladding layers each with a different refractive index. The top clad (411) is Boron doped, and the bottom clad (412) is SiO₂ (Col. 5, Lines 3-5). It would have been obvious to one of ordinary skill in the art at the time of invention to form the cladding layers each with a different refractive index in order to improve the re-flow characteristics of the top clad layer and thereby improve the gap-filling properties of the top clad as taught by Zhong (Col. 2, Lines 55-61).

Claim 30 is rejected under 35 U.S.C. 103(a) as being unpatentable over Japanese Patent JP 05224055 A in view of U.S. Patent 6,282,358 to Hornbeck.

As applied above, the '005 Patent discloses the method of the invention substantially as claimed, but does not expressly teach the use of chemical mechanical polishing to remove the excess core material. However, the '005 Patent teaches that other methods known in the art are equivalent to the etch-back process used.

Hornbeck teaches a method for forming a wave-guide in a trench including removing the excess core material by chemical mechanical polishing (Col. 7, Lines 40-65). It would have been obvious to one of ordinary skill in the art at the time of invention to use CMP to remove the excess core material in order to

Art Unit: 1763

form a substantially planar surface for the core as it is well known in the art that a smooth core material reduces light-signal transmission losses in the wave-guide.

Claims 32 and 34 are rejected under 35 U.S.C. 103(a) as being unpatentable over Japanese Patent JP 05224055 A in view of U.S. Patent 3,934,061 to Keck et al.

As applied above, the '055 reference teaches the method of the invention substantially as claimed but does not expressly teach cladding layers comprising glass.

The '055 patent teaches that the cladding layers are made from SiO₂, which reads on silica glass as broadly claimed by applicant. Nevertheless, Keck teaches that the use of glass for cladding layers is old and well known in the waveguide fabrication art. It would have been obvious to one of ordinary skill in the art at the time of invention to form the cladding layer using the conventional materials such as glasses.

Claims 35-41, 44, 46, 48 and 49 are rejected under 35 U.S.C. 103(a) as being unpatentable over JP 05224055 A in view of U.S. Patent 6,307,242 to Sugiyama, or alternatively U.S. Patent 6,282,358 to Hornbeck, or U.S. Patent 5,877,065 to Yallup.

Regarding Claim 35, as recited above, the '055 patent teaches the method of the invention substantially as claimed, but does not expressly teach that the semiconductor layer is disposed on a first insulating layer, and forming the opening to expose the first insulating layer.

Regarding Claims 37 and 48, the '005 patent fails to expressly teach forming the first insulating layer on a second insulating layer on a second insulating layer.

However the use of silicon-on-insulator substrates is notoriously old and well known in the waveguide fabrication art. For example, Sugiyama teaches forming a silicon semiconductor layer (12) on top of first and second insulating layers (9, 10), and forming the opening to expose the first insulating layer. (Figure 4A) Hornbeck et al. also teaches a method of forming a waveguide on first and second insulating layers to form a trench waveguide. (See Col. 7, Lines 18-25) Yallup further teaches forming a

Art Unit: 1763

semiconductor layer (10) on top of first insulating layer (34) forming an opening to expose the first layer (Figure 3), and depositing a bottom cladding layer conformally in the opening (Figure 4).

In view of the teachings of the above cited prior art references, it would have been obvious to one of ordinary skill in the art at the time of invention to modify the '005 patent to form the trench using first and second insulating layers in order to suitably form the trench to desired depth using an etch-stop layer as shown by the prior art references.

Regarding Claim 36, Sugiyama teaches that the first insulating layer may be silicon oxide. (Col. 5, Lines 63-66)

Regarding Claim 41, Sugiyama teaches a silicon semiconductor layer. (Col. 5, Lines 54-62)

Regarding Claims 44 and 46, both Sugiyama and the '055 patent teach silicon oxide cladding layers.

Regarding Claims 38, 39, 40 and 49, Official Notice is taken of the fact that silicon-on-insulator substrates are conventionally formed from silicon on insulating layers such as silicon oxide and glass, as stated above, and are routinely used in the waveguide fabrication art. It would have been obvious to one of ordinary skill in the art at the time of invention to form the silicon-on-insulator substrate in the conventional manner using a second insulating layer comprising silicon oxide or glass.

Claim 42 is rejected under 35 U.S.C. 103(a) as being unpatentable over JP 05224055 A in view of U.S. Patent 6,307,242 to Sugiyama, or alternatively U.S. Patent 6,282,358 to Hornbeck, or U.S. Patent 5,877,065 to Yallup as applied above to claims 35, 37 and 48, and in further view of U.S. Patent 6,553,170 to Zhong.

As applied above, the '005 Patent in view of U.S. Patent 6,307,242 to Sugiyama and alternate references discloses the method of the invention substantially as claimed, but does not teach that the cladding layers have a different refractive index.

However, it is well known in the art of wave-guide fabrication to form top, bottom and core layers of a wave-guide each having a different refractive index. Commonly the core layer must have a higher refractive index than the cladding layers as this aids in signal transmission. Also the top and bottom

Art Unit: 1763

cladding layers are typically close to the same index of refraction, however, they do not have to be exactly the same as shown by Zhong. Zhong teaches that it is old in the art to form a wave-guide in which the bottom cladding is different from the upper cladding. See Background of the Invention (Col. 2, Lines 1-3). Note that the top clad is made from BPSG and the bottom clad is SiO₂ silica. *Note that these different materials each have a different refractive index.* Zhong further teaches a method of forming a wave-guide having top and bottom cladding layers each with a different refractive index. The top clad (411) is Boron doped, and the bottom clad (412) is SiO₂ (Col. 5, Lines 3-5). It would have been obvious to one of ordinary skill in the art at the time of invention to form the cladding layers each with a different refractive index in order to improve the re-flow characteristics of the top clad layer and thereby improve the gap-filling properties of the top clad as taught by Zhong (Col. 2, Lines 55-61).

Claim 43 is rejected under 35 U.S.C. 103(a) as being unpatentable over Japanese Patent JP 05224055 A in view of U.S. Patent 6,307,242 to Sugiyama, or alternatively U.S. Patent 6,282,358 to Hornbeck, or U.S. Patent 5,877,065 to Yallup as applied above to claims 35, 37 and 48, and in further view of U.S. Patent 6,282,358 to Hornbeck.

As applied above, the '005 Patent in view of U.S. Patent 6,307,242 to Sugiyama and alternate references discloses the method of the invention substantially as claimed, but does not expressly teach the use of chemical mechanical polishing to remove the excess core material. However, the '005 Patent teaches that other methods known in the art are equivalent to the etch-back process used.

Hornbeck teaches a method for forming a wave-guide in a trench including removing the excess core material by chemical mechanical polishing (Col. 7, Lines 40-65). It would have been obvious to one of ordinary skill in the art at the time of invention to use CMP to remove the excess core material in order to form a substantially planar surface for the core as it is well known in the art that a smooth core material reduces light-signal transmission losses in the wave-guide.

Claims 45 and 47 are rejected under 35 U.S.C. 103(a) as being unpatentable over Japanese Patent JP 05224055 A in view of U.S. Patent 6,307,242 to Sugiyama, or alternatively U.S. Patent

Art Unit: 1763

6,282,358 to Hornbeck, or U.S. Patent 5,877,065 to Yallup as applied above to claims 35, 37 and 48, and in further view of U.S. Patent 3,934,061 to Keck et al.

As applied above, the '055 reference in view of U.S. Patent 6,307,242 to Sugiyama and alternate references teaches the method of the invention substantially as claimed but does not expressly teach cladding layers comprising glass.

The '055 patent teaches that the cladding layers are made from SiO₂, which reads on silica glass as broadly claimed by applicant. Nevertheless, Keck teaches that the use of glass for cladding layers is old and well known in the waveguide fabrication art. It would have been obvious to one of ordinary skill in the art at the time of invention to form the cladding layer using the conventional materials such as glasses.

Conclusion

All claims are drawn to the same invention claimed in the application prior to the entry of the submission under 37 CFR 1.114 and could have been finally rejected on the grounds and art of record in the next Office action if they had been entered in the application prior to entry under 37 CFR 1.114. Accordingly, **THIS ACTION IS MADE FINAL** even though it is a first action after the filing of a request for continued examination and the submission under 37 CFR 1.114. See MPEP § 706.07(b). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire **THREE MONTHS** from the mailing date of this action. In the event a first reply is filed within **TWO MONTHS** of the mailing date of this final action and the advisory action is not mailed until after the end of the **THREE-MONTH** shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than **SIX MONTHS** from the mailing date of this final action.

Art Unit: 1763

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Roberts Culbert whose telephone number is (571) 272-1433. The examiner can normally be reached on Monday-Friday (8:30-5:00).

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Parviz Hassanzadeh can be reached on (571) 272-1435. The fax phone number for the organization where this application or proceeding is assigned is 703-872-9306.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

R. Culbert



p. l.
PARVIZ HASSANZADEH
SUPERVISORY PATENT EXAMINER